

CLAIMS

1. Molecule or polypeptide composition, characterized by the presence in its structure of one or more peptide sequences bearing all or part of one or more T epitope(s) and, optionally, other epitopes, in particular B epitopes, characteristic of the proteins resulting from the infectious activity of P. falciparum in the hepatic cells.
2. Molecule or polypeptide composition according to Claim 1, containing at least one peptide sequence bearing all or part of one or more epitopes characteristic of a protein produced in the hepatocytes infected by P. falciparum and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence is represented by all or part of the amino acid sequence shown in Figure 9 or Figure 10, and which corresponds to the 3' end of the LSA gene.
3. Molecule or polypeptide composition according to Claim 1 or Claim 2, containing at least one peptide sequence bearing all or part of one or more epitope(s) characteristic of a protein produced in the hepatocytes infected by P. falciparum, and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence is represented by all or part of the following amino acid sequence :

RKADTKK¹NLERKKEHGDILAEDLYGRLEIP
 AIELPSENERGY²YIPHOSSLPQDN³RGNSRD
 SKEISII⁴EKTNR⁵ESITT⁶NVEGRRDIHKGHL
 EEKKG⁷SGSIKPEQKEDKS

this amino acid sequence being optionally preceded by all or part of one or more of the sequences of 17 amino acids of formula :

X₁DLEQX₂RX₃AKEKLQX₄QQ
 QX₁DLEQX₂RX₃AKEKLQX₄Q
 QQX₁DLEQX₂RX₃AKEKLQX₄
 X₄QQX₁DLEQX₂RX₃AKEKLQ
 QX₄QQX₁DLEQX₂RX₃AKEKL

LQX₄QQX₁DLEQX₂RX₃AKEK
 KLQX₄QQX₁DLEQX₂RX₃AKE
 EKLQX₄QQX₁DLEQX₂RX₃AK
 KEKLQX₄QQX₁DLEQX₂RX₃A
 AKEKLQX₄QQX₁DLEQX₂RX₃
 X₃AKEKLQX₄QQX₁DLEQX₂R
 RX₃AKEKLQX₄QQX₁DLEQX₂
 X₂RX₃AKEKLQX₄QQX₁DLEQ
 QX₂RX₃AKEKLQX₄QQX₁DLE
 EQX₂RX₃AKEKLQX₄QQX₁DL
 LEQX₂RX₃AKEKLQX₄QQX₁D
 DLEQX₂RX₃AKEKLQX₄QQX₁

in which :

- ° X₁ is "Ser" or "Arg",
- ° X₂ is "Glu" or "Asp"
- ° X₃ is "Arg" or "Leu"
- ° X₄ is "Glu" or "Gly"

4. Molecule according to one of the Claims 1 to 3, characterized by all or part of the following amino acid sequence :

LQEQORDLEQRKADTKKNLERKKEHGDILAEDLYGRLEIP
 AIELPSENERGYIIPHQSSLPQDNRGNSRDSKEISIIKT
 NRESITTNVEGRRDIHKHGLEKKDGSIKPEQKEDKS

5. Molecule according to Claim 1 or Claim 2, characterized by all or part of the following amino acid sequence :

DTKKNLERKKEHGDILAEDLYGRLEIP

6. Molecule according to Claim 1 or Claim 2, characterized by all or part of the following amino acid sequence :

ERRAKEKLQEQORDLEQRKADTKK

7. Molecule according to Claim 1 or Claim 2, characterized by all or part of the following amino acid sequence :

NSRDSKEISIIIEKTNRESITTNVEGRRDIHK

8. Molecule according to Claim 1, characterized by all or part of the following amino acid sequence :

**RDELFNELLNSVDVNGEVKENILEESQVNDDIFNSLVKSVQQEQQHNVEEKVE
ESVEENDEESVEENVEENVEENDDGSVASSVEESIASSVDESIDSSIENVAP
TVEEIVAPTVEEIVAPSVVEKCAPSVEESVAPSVEESVAEMLKER**

shown in Figure 3 and designated hereafter by the polypeptide 729S

9. Molecule according to Claim 1, characterized by all or part of the following amino acid sequence :

RDELFNELLNSVDVNGEVKENILEESQVNDDIFNSLVKSVQQEQQHN

10. Molecule according to any one of the Claims 1, 8 or 9, characterized in that it corresponds to all or part of one of the following amino acid sequences :

- DELFNELLNSVDVNGEVKENILEESQ,
- LEESQVNDDIFNSLVKSVQQEQQHNV,
- VEKCAPSVEESVAPSVEESVAEMLKER.

11. Molecule or polypeptide composition containing at least one peptide sequence bearing all or part of one or more epitope(s) characteristic of a protein produced in hepatocytes infected by P. falciparum, and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence is represented by all or part of the amino acid sequence shown in Figure 7, and which corresponds to the 5' end of the LSA gene.

12. Molecule or polypeptide composition according to Claim 1, containing at least one peptide sequence bearing all or part of one or more epitope(s) characteristic of a protein produced in hepatocytes infected by P. falciparum, and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence is represented by all or part of the sequence of the first 153 amino acids shown in Figure 7, this amino acid sequence being optionally followed by all or part of one or more of the sequences of 17 amino acids of formula :

X_1 DLEQX₂ RX₃ AKEKLQX₄ QQ
 QX₁ DLEQX₂ RX₃ AKEKLQX₄ Q
 QQX₁ DLEQX₂ RX₃ AKEKLQX₄
 X₄ QQX₁ DLEQX₂ RX₃ AKEKLQ
 QX₄ QQX₁ DLEQX₂ RX₃ AKEKL
 LQX₄ QQX₁ DLEQX₂ RX₃ AKEK
 KLQX₄ QQX₁ DLEQX₂ RX₃ AKE
 EKLOX₄ QQX₁ DLEQX₂ RX₃ AK
 KEKLQX₄ QQX₁ DLEQX₂ RX₃ A
 AKEKLQX₄ QQX₁ DLEQX₂ RX₃
 X₃ AKEKLQX₄ QQX₁ DLEQX₂ R
 RX₃ AKEKLQX₄ QQX₁ DLEQX₂
 X₂ RX₃ AKEKLQX₄ QQX₁ DLEQ
 QX₂ RX₃ AKEKLQX₄ QQX₁ DLE
 EQX₂ RX₃ AKEKLQX₄ QQX₁ DL
 LEQX₂ RX₃ AKEKLQX₄ QQX₁ D
 DLEQX₂ RX₃ AKEKLQX₄ QQX₁

in which :

- ° X₁ is "Ser" or "Arg",
- ° X₂ is "Glu" or "Asp"
- ° X₃ is "Arg" or "Leu"
- ° X₄ is "Glu" or "Gly"

13. Molecule or polypeptide composition according to Claim 1, containing at least one peptide sequence bearing all or part of one or more epitope(s) characteristic of a protein produced in hepatocytes infected by P. falciparum, and more particularly bearing all or part of one or more T epitope(s) of the proteins produced at the hepatic stage of P. falciparum, characterized in that this peptide sequence includes successively :

- all or part of the sequence of the first 153 amino acids shown in Figure 7,
- optionally, all or part of one or more sequences of 17 amino acids of formula :

X_1 DLEQX₂ RX₃ AKEKLQX₄ QQ
 QX₁ DLEQX₂ RX₃ AKEKLQX₄ Q
 QQX₁ DLEQX₂ RX₃ AKEKLQX₄
 X₄ QQX₁ DLEQX₂ RX₃ AKEKLQ
 QX₄ QQX₁ DLEQX₂ RX₃ AKEKL
 LQX₄ QQX₁ DLEQX₂ RX₃ AKEK
 KLQX₄ QQX₁ DLEQX₂ RX₃ AKE
 EKLOX₄ QQX₁ DLEQX₂ RX₃ AK
 KEKLQX₄ QQX₁ DLEQX₂ RX₃ A
 AKEKLQX₄ QQX₁ DLEQX₂ RX₃
 X₃ AKEKLQX₄ QQX₁ DLEQX₂ R
 RX₃ AKEKLQX₄ QQX₁ DLEQX₂
 X₂ RX₃ AKEKLQX₄ QQX₁ DLEQ
 QX₂ RX₃ AKEKLQX₄ QQX₁ DLE
 EQX₂ RX₃ AKEKLQX₄ QQX₁ DL
 LEQX₂ RX₃ AKEKLQX₄ QQX₁ D
 DLEQX₂ RX₃ AKEKLQX₄ QQX₁

in which :

- ° X₁ is "Ser" or "Arg",
- ° X₂ is "Glu" or "Asp"
- ° X₃ is "Arg" or "Leu"
- ° X₄ is "Glu" or "Gly"

- and all or part of the last 279 amino acids shown in Figure 10.

14. Peptide sequence derived from a molecule according to one of the Claims 1 to 13, this sequence exhibiting modifications by substitution of maximally 40% of the amino acids while conserving the biological activity of the molecule mentioned above, in particular the induction of a response of the T lymphocytes, in particular of the cytotoxic T lymphocytes.

15. Immunogenic composition characterized by the combination of a molecule conforming to any one of the Claims 1 to 14 with a pharmaceutically acceptable vehicle.

17. Nucleotide sequence corresponding according to the universal genetic code to a peptide sequence such as defined in one of the Claims 1 to 14.

19. In vitro diagnostic method for malaria in an individual likely to be infected by P. falciparum which comprises the placing of a tissue or a biological fluid taken from an individual in contact with a polypeptide composition according to Claims 1 to 14 under conditions allowing an in vitro immunological reaction to occur between the said polypeptide composition and the antibodies possibly present in the biological tissue, and the in vitro detection of the antigen-antibody complexes possibly formed.

20. In vitro diagnostic method for malaria in an individual likely to be infected by P. falciparum which comprises the placing of a tissue or a biological fluid taken from an individual in contact with antibodies according to Claim 18 under conditions allowing an in vitro immunological reaction to occur between the said antibodies and the proteins specific for P. falciparum possibly present in the biological tissue, and the in vitro detection of the antigen-antibody complexes possibly formed.

21. Kit for the in vitro diagnosis of malaria according to Claim 19, characterized in that it contains :

- one or more polypeptide composition(s) according to one of the Claims 1 to 14,
- the reagents for making up a suitable medium for carrying out the immunological reaction,
- the reagents allowing the detection of the antigen-antibody complexes produced as a result of the immunological reaction, these reagents also may bear a label or be capable of being recognized in turn by a labelled reagent, more particularly in the case in which the above-mentioned polypeptide composition is not labelled.

22. Kit for the in vitro diagnosis of malaria according to Claim 20, characterized in that it contains :

- antibodies according to Claim 18,

26. Use of one or more monoclonal or polyclonal antibodies according to Claim 18 for the preparation of a medicine intended for the treatment of malaria.